REJ10B0135-0100H

Everywhere you imagine.

RENESAS

SuperH™ Family E10A-USB Emulator

Additional Document for User's Manual

E10A-USB for SH7616 HS7616KCU01HE

Renesas Microcomputer Development Environment System

SuperH™ Family / SH7600 Series

Supplementary Information on Using the SH7616

User's Manual

Rev.1.00
Revision Date: Jun. 30, 2004

Renesas Technology
www.renesas.com

Keep safety first in your circuit designs!

1. Renesas Technology Corp. puts the maximum effort into making semiconductor products better and more reliable, but there is always the possibility that trouble may occur with them. Trouble with semiconductors may lead to personal injury, fire or property damage.
   Remember to give due consideration to safety when making your circuit designs, with appropriate measures such as (i) placement of substitutive, auxiliary circuits, (ii) use of nonflammable material or (iii) prevention against any malfunction or mishap.

Notes regarding these materials

1. These materials are intended as a reference to assist our customers in the selection of the Renesas Technology Corp. product best suited to the customer's application; they do not convey any license under any intellectual property rights, or any other rights, belonging to Renesas Technology Corp. or a third party.
2. Renesas Technology Corp. assumes no responsibility for any damage, or infringement of any third-party's rights, originating in the use of any product data, diagrams, charts, programs, algorithms, or circuit application examples contained in these materials.
3. All information contained in these materials, including product data, diagrams, charts, programs and algorithms represents information on products at the time of publication of these materials, and are subject to change by Renesas Technology Corp. without notice due to product improvements or other reasons. It is therefore recommended that customers contact Renesas Technology Corp. or an authorized Renesas Technology Corp. product distributor for the latest product information before purchasing a product listed herein.
   The information described here may contain technical inaccuracies or typographical errors.
   Renesas Technology Corp. assumes no responsibility for any damage, liability, or other loss rising from these inaccuracies or errors.
   Please also pay attention to information published by Renesas Technology Corp. by various means, including the Renesas Technology Corp. Semiconductor home page (http://www.renesas.com).
4. When using any or all of the information contained in these materials, including product data, diagrams, charts, programs, and algorithms, please be sure to evaluate all information as a total system before making a final decision on the applicability of the information and products. Renesas Technology Corp. assumes no responsibility for any damage, liability or other loss resulting from the information contained herein.
5. Renesas Technology Corp. semiconductors are not designed or manufactured for use in a device or system that is used under circumstances in which human life is potentially at stake. Please contact Renesas Technology Corp. or an authorized Renesas Technology Corp. product distributor when considering the use of a product contained herein for any specific purposes, such as apparatus or systems for transportation, vehicular, medical, aerospace, nuclear, or undersea repeater use.
6. The prior written approval of Renesas Technology Corp. is necessary to reprint or reproduce in whole or in part these materials.
7. If these products or technologies are subject to the Japanese export control restrictions, they must be exported under a license from the Japanese government and cannot be imported into a country other than the approved destination.
   Any diversion or reexport contrary to the export control laws and regulations of Japan and/or the country of destination is prohibited.
8. Please contact Renesas Technology Corp. for further details on these materials or the products contained therein.

Contents

Section 1 Connecting the Emulator with the User System 1
1.1 Components of the Emulator 1
1.2 Connecting the E10A-USB Emulator with the User System 2
1.3 Installing the H-UDI Port Connector on the User System 2
1.4 Pin Assignments of the H-UDI Port Connector 2
1.5 Recommended Circuit between the H-UDI Port Connector and the MPU 4
1.5.1 Recommended Circuit 4

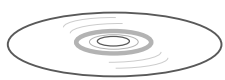
Section 2 Specifications of the Software when Using the SH7616 7
2.1 Differences between the SH7616 and the Emulator 7
2.2 Specific Functions for the Emulator when Using the SH7616 10
2.2.1 Break Condition Functions 11
2.2.2 Trace Functions 12
2.2.3 Notes on Using the JTAG Clock (TCK) 12
2.2.4 Notes on Setting the [Breakpoint] Dialog Box 13
2.2.5 Notes on Setting the [Break Condition] Dialog Box and BREAKCONDITION_SET Command 14

Section 1 Connecting the Emulator with the User System

1.1 Components of the Emulator

The E10A-USB emulator supports the SH7616. Table 1.1 lists the components of the emulator.

Table 1.1 Components of the Emulator

Classi-fication	Component	Appearance	Quan-tity	Remarks
Hard-ware	Emulator box		1	HS0005KCU01H: Depth: 65.0 mm, Width: 97.0 mm, Height: 20.0 mm, Mass: 72.9 g or HS0005KCU02H: Depth: 65.0 mm, Width: 97.0 mm, Height: 20.0 mm, Mass: 73.7 g
	User system interface cable		1	14-pin type: Length: 20 cm, Mass: 33.1 g
	USB cable		1	Length: 150 cm, Mass: 50.6 g
Soft-ware	SH7616 E10A-USB emulator setup program, SuperH™ Family E10A-USB Emulator User's Manual, Supplementary Information on Using the SH7616*, and Test program manual for HS0005KCU01H and HS0005KCU02H		1	HS0005KCU01SR, HS0005KCU01HJ, HS0005KCU01HE, HS7616KCU01HJ, HS7616KCU01HE, HS0005TM01HJ, and HS0005TM01HE (provided on a CD-R)

Note: Additional document for the MPUs supported by the emulator is included. Check the target MPU and refer to its additional document.

1.2 Connecting the E10A-USB Emulator with the User System

To connect the E10A-USB emulator (hereinafter referred to as the emulator), the H-UDI port connector must be installed on the user system to connect the user system interface cable. When designing the user system, refer to the recommended circuit between the H-UDI port connector and the MCU. In addition, read the E10A-USB emulator user's manual and hardware manual for the related device.

Table 1.2 shows the type number of the E10A-USB emulator, the corresponding connector type, and the use of AUD function.

Table 1.2 Type Number, AUD Function, and Connector Type

Type Number	Connector	AUD Function
HS0005KCU01H, HS0005KCU02H	14-pin connector	Not available

1.3 Installing the H-UDI Port Connector on the User System

Table 1.3 shows the recommended H-UDI port connectors for the emulator.

Table 1.3 Recommended H-UDI Port Connectors

Connector	Type Number	Manufacturer	Specifications
14-pin connector	2514-6002	Minnesota Mining & Manufacturing Ltd.	14-pin straight type

Note: When designing the 14-pin connector layout on the user board, do not place any components within 3 mm of the H-UDI port connector.

1.4 Pin Assignments of the H-UDI Port Connector

Figures 1.1 shows the pin assignments of the H-UDI port connector.

Note: Note that the pin number assignments of the H-UDI port connector shown on the following page differ from those of the connector manufacturer.

Pin No.	Signal	Input/ Output*[1]	SH7616 Pin No.	Note
1	TCK	Input	30	
2*[2]	/TRST	Input	32	
3	TDO	Output	28	
4	N.C.	—	—	
5	TMS	Input	31	
6	TDI	Input	29	
7*[2]	/RESETP	Output	8	
8	N.C.	—	—	
9*[5]	(GND)	—	—	
11*[4]	UVCC	Output	—	
10, 12, and 13	GND	—	—	
14*[3]	GND	Output	—	

Notes: 1. Input to or output from the user system.
2. The slash (/) means that the signal is active-low.
3. The emulator monitors the GND signal of the user system and detects whether or not the user system is connected.
4. If the VccQ pin is not connected to the UVCC, the I/O voltage of the user system interface will be fixed to 3.3 V.
5. The /ASEMD0 pin must be 0 when the emulator is connected and 1 when the emulator is not connected, respectively.
(1) When the emulator is used: /ASEMD0 = 0 (ASE mode)
(2) When the emulator is not used: /ASEMD0 = 1 (normal mode)
To allow the /ASEMD0 pin to be GND by connecting the user system interface cable, connect pin 9 directly to the /ASEMD0 pin. Do not ground the pin.

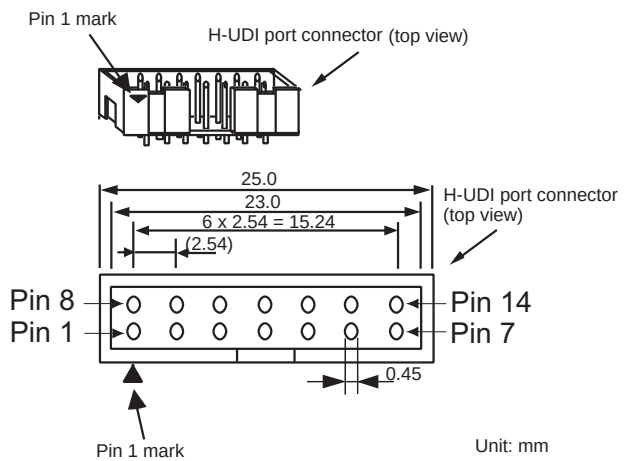


Figure 1.1 Pin Assignments of the H-UDI Port Connector (14 Pins)

1.5 Recommended Circuit between the H-UDI Port Connector and the MPU

1.5.1 Recommended Circuit

Figure 1.2 shows a recommended circuit for connection between the H-UDI and AUD port connectors (14 pins) and the MPU when the emulator is in use. Figure 1.3 shows a circuit for connection when UVCC is not connected.

Notes: 1. Do not connect anything to the N.C. pins of the H-UDI port connector.

2. The /ASEMODE pin must be 0 when the emulator is connected and 1 when the emulator is not connected, respectively.
   (1) When the emulator is used: /ASEMODE = 0 (ASE mode)
   (2) When the emulator is not used: /ASEMODE = 1 (normal mode)
   Figures 1.2 and 1.3 show examples of circuits that allow the /ASEMODE pin to be GND (0) whenever the emulator is connected by using the user system interface cable. When the /ASEMODE pin is changed by switches, etc., ground pin 9. Do not connect this pin to the /ASEMODE pin.
3. When a network resistance is used for pull-up, it may be affected by a noise. Separate TCK from other resistances.
4. The pattern between the H-UDI port connector and the MPU must be as short as possible. Do not connect the signal lines to other components on the board.
5. When the power supply of the user system is turned off, supplying VccQ of the user system to the UVCC pin reduces the leakage current from the emulator to the user system. A level shifter that is activated by the internal power supply or user power supply (changed by the switch) is installed in the interface circuit of the emulator. If the user power is supplied to the UVCC pin, the level shifter is not activated as long as no user power is supplied. When the power supply of the user system is turned off, no current flows from the user interface. The I/O voltage level of the user system interface can be the same as that of the VccQ. To operate the emulator with low voltage (lower than 3.3 V), the VccQ must be supplied to the UVCC pin. Make the emulator's switch settings so that the VccQ will be supplied (SW2 = 1 and SW3 = 1) (as shown in figure 1.2).
6. The resistance values shown in figures 1.2 and 1.3 are recommended.
7. For the pin processing in cases where the emulator is not used, refer to the hardware manual of the related MPU.

When the circuit is connected as shown in figure 1.2, the switches of the emulator are set as SW2 = 1 and SW3 = 1. For details, refer to section 3.8, Setting the DIP Switches, in the Debugger Part of the SuperH™ Family E10A-USB Emulator User's Manual.

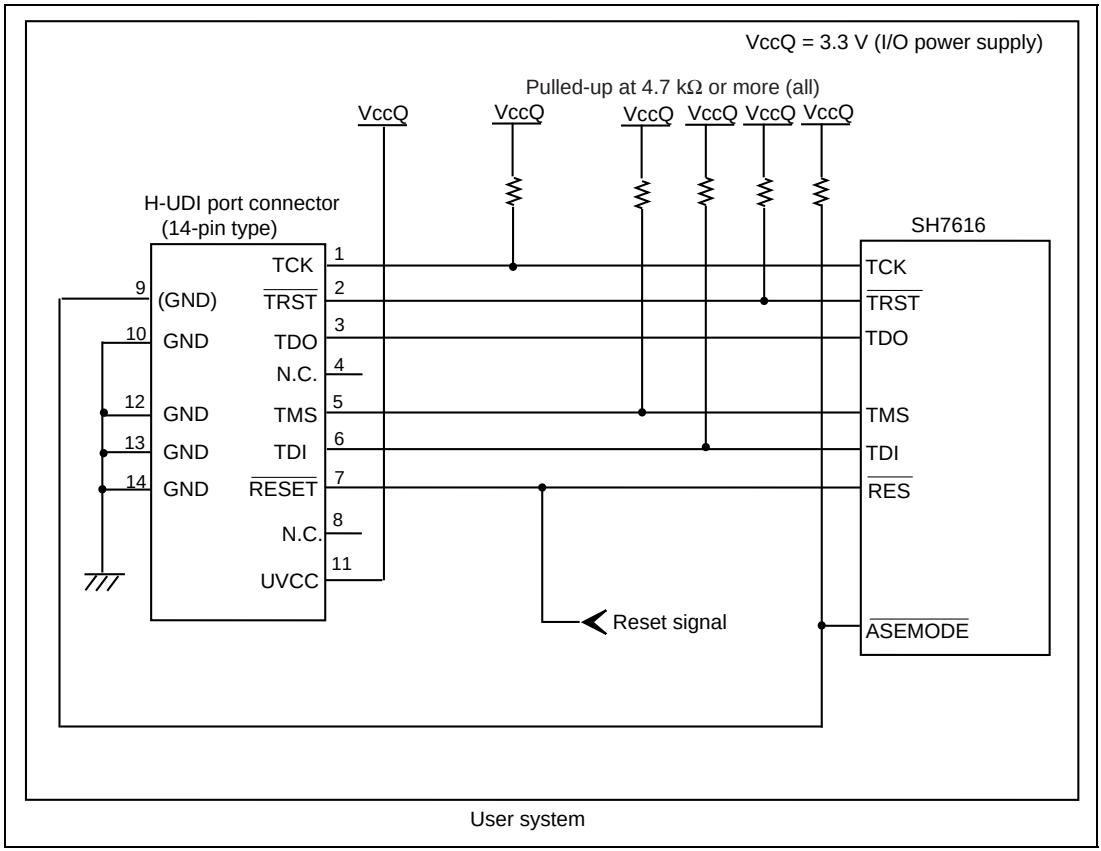


Figure 1.2 Recommended Circuit for Connection between the H-UDI Port Connector and MPU when the Emulator is in Use (14-Pin Type UVCC Connected)

When the circuit is connected as shown in figure 1.3, the switches of the emulator are set as SW2 = 0 and SW3 = 1. For details, refer to section 3.8, Setting the DIP Switches, in the Debugger Part of the SuperH™ Family E10A-USB Emulator User's Manual.

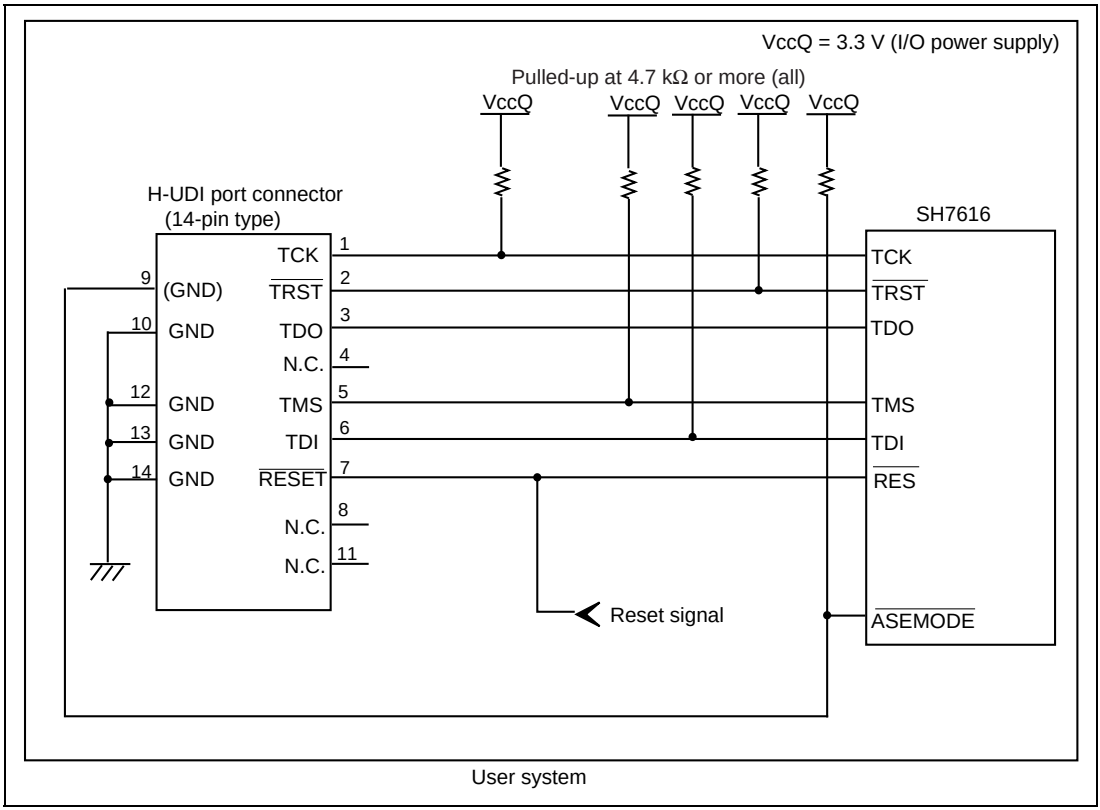


Figure 1.3 Circuit for Connection between the H-UDI Port Connector and MPU when the Emulator is in Use (14-Pin Type UVCC Not Connected*)

Note: When UVCC is not connected and the user system is turned off, note that the leakage current flows from the emulator to the user system.

Section 2 Specifications of the Software when Using the SH7616

2.1 Differences between the SH7616 and the Emulator

1. When the emulator system is initiated, it initializes the general registers and part of the control registers as shown in table 2.1. The initial values of the actual SH7616 registers are undefined. When the emulator is initiated from the workspace, a value to be entered is saved in a session.

Table 2.1 Register Initial Values at Emulator Link Up

Register	Emulator at Link Up
R0 to R14	H'00000000
R15 (SP)	Value of the SP in the vector address table
PC	Value of the PC in the vector address table
SR	H'000000F0
GBR	H'00000000
VBR	H'00000000
MACH	H'00000000
MACL	H'00000000
PR	H'00000000
RS	H'00000000
RE	H'00000000
MOD	H'00000000
A0G, A1G	H'00000000
A0, A1	H'00000000
X0, X1	H'00000000
Y0, Y1	H'00000000
M0, M1	H'00000000
DSR	H'00000000

2. The emulator uses the H-UDI; do not access the H-UDI.

3. Low-Power States (Sleep and Standby)

   For low-power consumption, the SH7616 has sleep and standby modes.

   The sleep and standby modes are switched using the SLEEP instruction. The sleep mode can be cleared by either normal clearing or by the satisfaction of a break condition (including BREAK key input), and the user program breaks. The standby mode can be cleared with the normal clearing function, and after the standby mode is cleared, the user program operates correctly. Note that, however, if a command has been entered in standby mode, no commands can be used from the emulator after the standby mode is cleared. The states cannot be canceled by the [STOP] button.

Notes: 1. After the sleep mode is cleared by a break, execution restarts at the instruction following the SLEEP instruction.

2. If the memory is accessed or modified in sleep mode, the sleep mode is cleared and execution starts at the instruction following the SLEEP instruction.

4. /RES Signal

   The SH7616 /RES signal is only valid during user program execution started with clicking the GO or STEP-type button. If this signal is enabled on the user system in command input wait state, it is not sent to the SH7616.

Note: Do not start user program execution or access the memory while the control input signal (/RES, /WAIT, or /BRLS) is being low. A TIMEOUT error will occur.

5. Direct Memory Access Controller (DMAC)

   The DMAC operates even when the emulator is used. When a data transfer request is generated, the DMAC executes DMA transfer.

Note: If the DMAC transfer is in the burst mode and the transfer size is 4 Mbytes or more, a TIMEOUT error will occur.

6. Memory Access during User Program Execution

   When a memory is accessed from the memory window, etc. during user program execution, the user program is resumed after it has stopped in the emulator to access the memory. Therefore, realtime emulation cannot be performed.

   The stopping time of the user program is as follows:

   Environment:

   Host computer: 650 MHz (Pentium® III)
   SH7616: 50 MHz (CPU clock)
   JTAG clock: 10 MHz (TCK clock)

   When a one-byte memory is read from the command-line window, the stopping time will be about 35 ms.

7. Memory Access during User Program Break

   The emulator can download the program for the flash memory area (refer to section 6.22, Download Function to the Flash Memory Area, in the Debugger Part of the SuperH™ Family E10A-USB Emulator User's Manual). Other memory write operations are enabled for the RAM area. Therefore, an operation such as memory write or BREAKPOINT should be set only for the RAM area.

8. Cache Operation during User Program Break

   When cache is enabled, the emulator accesses the memory by the following methods:

   At memory write: Writes through the cache, then writes to the memory.

   At memory read: Does not change the cache write mode that has been set.

   Therefore, when memory read or write is performed during user program break, the cache state will be changed.

9. Loading Sessions

   Information in [JTAG clock] of the [Configuration] dialog box cannot be recovered by loading sessions. Thus the TCK value will be 2.5 MHz.

10. [IO] Window

    - Display and modification

      Do not change values of the User Break Controller because it is used by the emulator.

      For each Watchdog Timer register, there are two registers to be separately used for write and read operations.

Table 2.2 Watchdog Timer Register

Register Name	Usage	Register
WTCSR(W)	Write	Watchdog timer control/status register
WTCNT(W)	Write	Watchdog timer counter
WTCSR(R)	Read	Watchdog timer control/status register
WTCNT(R)	Read	Watchdog timer counter

    - The watchdog timer operates only when the user program is executed. Do not change the value of the frequency change register in the [IO] window or [Memory] window.
    - The internal I/O registers can be accessed from the [IO] window. After the I/O-register definition file is created, the MPU's specification may be changed. If each I/O register in the I/O-register definition file differs from addresses described in the hardware manual, change the I/O-register definition file according to the description in the hardware manual. The I/O-register definition file can be customized depending on its format. Note that, however, the emulator does not support the bit-field function.
    - Verify

      In the [IO] window, the verify function of the input value is disabled.

11. Illegal Instructions

    If illegal instructions are executed by STEP-type commands, the emulator cannot go to the next program counter.

12. Interrupts

    While the emulator is executing the user program, any interrupt to the SH7616 can be used. While the emulator is waiting for command input, interrupts are not processed. However, if an edge sensitive interrupt occurs in command input wait state, the emulator holds the interrupt and executes the interrupt processing routine when the GO command is entered.

13. When accessing the reserved memory area, use the [Memory] window; do not use other windows.

2.2 Specific Functions for the Emulator when Using the SH7616

The SH7616 does not support the following functions:

- MMU-related functions (The SH7616 does not mount the MMU.)
  - VPMAP-related command
  - Virtual and Physical specification in the [Configuration] window
  - Virtual and Physical specification on the command-line function
  - Virtual and Physical specification in the [Breakpoint] window
  - LDTLB instruction execution break function
  - MEMORYAREA_SET command
- AUD trace function
- Internal I/O access break function
- UBC_MODE command (The UBC function cannot be used while the emulator is being used.)
- UBC_MODE specification in the [Configuration] window or on the command line
- Profiler function
- Performance measurement function

2.2.1 Break Condition Functions

In the emulator, four break conditions can be set (Break Condition 1,2,3,4). Table 2.3 lists the items that can be specified for each.

Table 2.3 Types of Break Conditions

Break Condition Type	Description
Address bus condition (Address)	Breaks when the SH7616 address bus value matches the specified value.
Data bus condition (Data)	Breaks when the SH7616 data bus value matches the specified value. Byte, word, or longword can be specified as the access data size.
Read or write condition (Read or Write)	Breaks in the read or write cycle.
Access type condition	Breaks when the bus cycle is the specified cycle.
Count condition	Breaks when the conditions set are satisfied the specified number of times.

Table 2.4 lists the combinations of conditions that can be set under Break Condition 1,2,3,4.

Table 2.4 Dialog Boxes for Setting Hardware Break Conditions

	Condition			
Dialog Box	Address Bus Condition ([Address] page)	Data Condition ([Data] page)	Access Type Condition, Read or Write Condition ([Bus state] page)	Count Condition ([Count] page)
[Break Condition 1,2] dialog box	O	O	O	O
[Break Condition 3,4] dialog box	O	X	O	X

Note: O: Can be set by checking the radio button in the dialog box.
X: Cannot be set in the dialog box.

Table 2.5 lists the combinations of conditions that can be set under BREAKCONDITION_SET commands.

Table 2.5 Commands for Setting Software Breakpoints

	Condition			
Channel	**Address Bus Condition (<addropt> option)**	**Data Condition (<dataopt> option)**	**Access Type Condition (<accessopt> option), Read or Write Condition (<r/wopt> option)**	**Count Condition (<Countopt> option)**
Break Condition 1,2	O	O	O	O
Break Condition 3,4	O	X	O	X

Note: O: Can be set by the BREAKCONDITION_SET command.
X: Cannot be set by the command.

2.2.2 Trace Functions

The trace function when using the SH7616 uses the branch-instruction trace function in the SH7616. It displays the branch-source and branch-destination addresses, the mnemonic, operand, and trace information can be acquired in realtime.

Notes: 1. The trace information on the four latest branch instructions can be acquired. This includes the information when execution branches from the emulator program to the user program. Therefore, when four or more branches occur, the four latest branch instructions are acquired; when three or less branches occur, the information on the branch from the emulator program to the user program is displayed.

2. The emulator address may be displayed in the [Trace] window at the last address when the user program is stopped. In such a case, the following message will be displayed. Ignore this address because it is not a user-program-related address.

*** EML ***

2.2.3 Notes on Using the JTAG Clock (TCK)

1. Set the JTAG clock (TCK) frequency to lower than the frequency of the SH7616 peripheral module clock (CKP).
2. Do not set 20 MHz for the JTAG clock (TCK).

2.2.4 Notes on Setting the [Breakpoint] Dialog Box

1. When an odd address is set, the next lowest even address is used.
2. A BREAKPOINT is accomplished by replacing instructions. Accordingly, it can be set only to the RAM area. However, a BREAKPOINT cannot be set to the following addresses:
   - An address whose memory content is H'0000
   - An area other than RAM
   - An area of address H’40000000 and the followings
   - An instruction in which Break Condition 4 is satisfied
   - A slot instruction of a delayed branch instruction
   - A lower 16-bit address of the 32-bit DSP instruction
3. During step operation, BREAKPOINTs are disabled.
4. Conditions set at Break Condition 4 are disabled when an instruction to which a BREAKPOINT has been set is executed. Do not set a BREAKPOINT to an instruction in which Break Condition 4 is satisfied.
5. When execution resumes from the breakpoint address after the program execution stops at the breakpoint, single-step operation is performed at the address before execution resumes. Therefore, realtime operation cannot be performed.
6. When a BREAKPOINT is set to the slot instruction of a delayed branch instruction, the exceptions of the illegal slot instruction occur although the program does not stop. Accordingly, do not set a BREAKPOINT to the slot instruction of a delayed branch instruction.
7. If a BREAKPOINT is set at a part of the repeating instructions where the BRA instruction cannot be set, it is handled as the general illegal instruction. In addition, because of the instruction restriction in the repeating loop, a break may or may not occur. Before and after the start or end of the loop, interrupts may not be accepted.
8. Settings of BREAKPOINT and Break Condition 1,2,3,4 are invalid while the STEP OVER function is being used.
9. When a BREAKPOINT is set to the cacheable area, the cache block containing the BREAKPOINT address is filled immediately before and after user program execution.
10. If an address of a BREAKPOINT cannot be correctly set in the ROM or flash memory area, a mark ● will be displayed in the [BP] area of the address on the [Editor] or [Disassembly] window by refreshing the [Memory] window, etc. after Go execution. However, no break will occur at this address. When the program halts with the break condition, the mark ● disappears.

2.2.5 Notes on Setting the [Break Condition] Dialog Box and BREAKCONDITION_SET Command

1. When [Go to cursor], [Step In], [Step Over], or [Step Out] is selected, the settings of Break Condition 4 are disabled.
2. Break Condition 4 is disabled when an instruction to which a BREAKPOINT has been set is executed. Accordingly, do not set a BREAKPOINT to an instruction which satisfies Break Condition 4.
3. When a Break Condition is satisfied, emulation may stop after two or more instructions have been executed.
4. If a PC break address condition is set to the slot instruction after a delayed branch instruction, user program execution cannot be terminated before the slot instruction execution; execution stops before the branch destination instruction.
5. Settings of BREAKPOINT and Break Condition 1,2,3,4 are disabled while the STEP OVER function is being used.

SuperH™ Family E10A-USB Emulator
Additional Document for User's Manual
Supplementary Information on Using the SH7616

Publication Date: Rev.1.00, June 30, 2004
Published by: Sales Strategic Planning Div.
Renesas Technology Corp.
Edited by: Technical Documentation & Information Department
Renesas Kodaira Semiconductor Co., Ltd.

© 2004. Renesas Technology Corp., All rights reserved. Printed in Japan.

Renesas Technology Corp. Sales Strategic Planning Div. Nippon Bldg., 2-6-2, Ohte-machi, Chiyoda-ku, Tokyo 100-0004, Japan

RENESAS SALES OFFICES

http://www.renesas.com

Renesas Technology America, Inc.
450 Holger Way, San Jose, CA 95134-1368, U.S.A
Tel: <1> (408) 382-7500 Fax: <1> (408) 382-7501

Renesas Technology Europe Limited.
Dukes Meadow, Millboard Road, Bourne End, Buckinghamshire, SL8 5FH, United Kingdom
Tel: <44> (1628) 585 100, Fax: <44> (1628) 585 900

Renesas Technology Europe GmbH
Dornacher Str. 3, D-85622 Feldkirchen, Germany
Tel: <49> (89) 380 70 0, Fax: <49> (89) 929 30 11

Renesas Technology Hong Kong Ltd.
7/F., North Tower, World Finance Centre, Harbour City, Canton Road, Hong Kong
Tel: <852> 2265-6688, Fax: <852> 2375-6836

Renesas Technology Taiwan Co., Ltd.
FL 10, #99, Fu-Hsing N. Rd., Taipei, Taiwan
Tel: <886> (2) 2715-2888, Fax: <886> (2) 2713-2999

Renesas Technology (Shanghai) Co., Ltd.
26/F., Ruijin Building, No.205 Maoming Road (S), Shanghai 200020, China
Tel: <86> (21) 6472-1001, Fax: <86> (21) 6415-2952

Renesas Technology Singapore Pte. Ltd.
1, Harbour Front Avenue, #06-10, Keppel Bay Tower, Singapore 098632
Tel: <65> 6213-0200, Fax: <65> 6278-8001

SuperH™ Family E10A-USB Emulator Additional Document for User's Manual

Renesas Technology Corp.
2-6-2, Ote-machi, Chiyoda-ku, Tokyo, 100-0004, Japan